Policy Forum

Effectiveness of Adherence to Standardized Hypertension Management by Primary Health Care Workers in China: a Cross-sectional Survey 3 Years after the Healthcare Reform

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The standardized hypertension management provided by primary health care workers is an important part of China's recent health care reform efforts. Investigating 5,116 hypertensive patients from a cross-sectional survey conducted by the Chinese Center for Disease Control and Prevention in 2012, this study found that adherence to standardized hypertension management is associated with positive effects on hypertension-related knowledge, healthy lifestyle behavior, antihypertensive medical treatments, and blood pressure control. It will be necessary to provide primary health care workers with sufficient training and reasonable incentives to ensure the implementation and effectiveness of hypertension management.

Key words: Hypertension; Primary health care; Community health workers; China

Hypertension is a major global public health problem contributing to heart disease, stroke, kidney failure, premature mortality, and disability. In China, the prevalence of hypertension in adults rocketed from 18.8% in 2002 to 33.5% in 2010[1], while the diagnosis and treatment rates of hypertension remained low[2]. A recent analysis revealed that the awareness, treatment, and control rates of hypertension in 115 communities in China were 41.6%, 34.4%, and 8.2%, respectively[3].

In 2009, China launched new health care reforms, with most of the strategies closely linked to chronic disease control, including management of hypertension[4]. Hypertensive patients aged 35 years and above were provided free management services by the local primary health care workers, who were responsible for establishing health files, providing annual basic health examinations, and regular follow-ups at least four times per patient per year. According to the National Essential Public Health Services Specifications (2011), the aforementioned process, as a whole, was regarded as the standardized management. The national government designated general practitioners, public health practitioners, nurses, and village doctors working at primary health care institutions (PHIs) as hypertension management service providers, and they were referred to as 'gatekeepers in health care.' PHIs included community health centers/stations in urban areas and township hospitals/clinics in rural areas. Although there was a large influx of funds from the national and local governments and a great deal of efforts from PHIs, there were concerns about the implementation and effectiveness of the hypertension management program. Grassroots health workers, particularly village doctors whose education and training were rather of a low standard, were thought to be inadequately qualified to provide the standardized care[5].

In 2012, after 3 years of the health care reform, the Chinese Center for Disease Control and Prevention (China CDC) conducted a survey to estimate the implementation and effects of adherence to the standardized hypertension management program. The analysis was conducted under the assumption that if the management procedures were implemented, the standardized management rate should be high, leading to improved healthy lifestyle behaviors and blood pressure control.

In this cross-sectional survey, 8 out of the 31 Chinese mainland provincial-level administrative regions were selected to ensure a broad geographical representation: Jiangsu, Zhejiang, Jiangxi, Hubei, Sichuan, Guangxi, Yunnan, and Xinjiang. From these provinces, 15 districts or counties were selected based on the intention and ability of the local CDC to accept the commitment, with one county and one district selected from each province except for only one county being selected

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from the Zhejiang province. Using stratified random sampling, all PHIs of each district or county were divided into three groups (good, medium, and poor) based on their performance assessment within the district or county in 2011. One PHI was randomly selected from each group, resulting in a total of 45 PHIs. Using proportion sampling, a total of 400 (if urban) or 300 (if rural) hypertensive patients were randomly sampled from each of these selected PHIs. The inclusion criteria were as follows: (1) having been diagnosed with hypertension by a physician according to the definition of measured blood pressure ≥ 140/90 mmHg or treatment with antihypertensive drugs; (2) age 35 years and above; and (3) having health records in PHIs for at least 1 year with the intention of covering the whole cycle of the standardized management. The exclusion criteria were non-fulfillment of the survey by patient due to a cognitive impairment, a physical disability, or a lack of contact during the survey. The sampled patients with the exclusion criteria were substituted by randomly-sampled patients to ensure the sample size. The sampling flowcharts are shown in Figure 1.

Questionnaires were used to collect information on the socioeconomic status, health knowledge, modifiable indicators of a hypertension risk, and health service utilization. The interviews were conducted in person by trained workers from the local CDC. The demographic, socioeconomic, and clinical factors that were investigated included gender, age, marital status, education, household income, medical insurance, and the duration of hypertension diagnosis. The standardized management was the main analytical factor measured. If the local primary health care workers followed up with a hypertensive patient at least four times during the last year and if they measured the patient's blood pressure, enquired about relevant symptoms, and provided healthy lifestyle advice during each follow-up, the patient was considered to have received the standardized management.

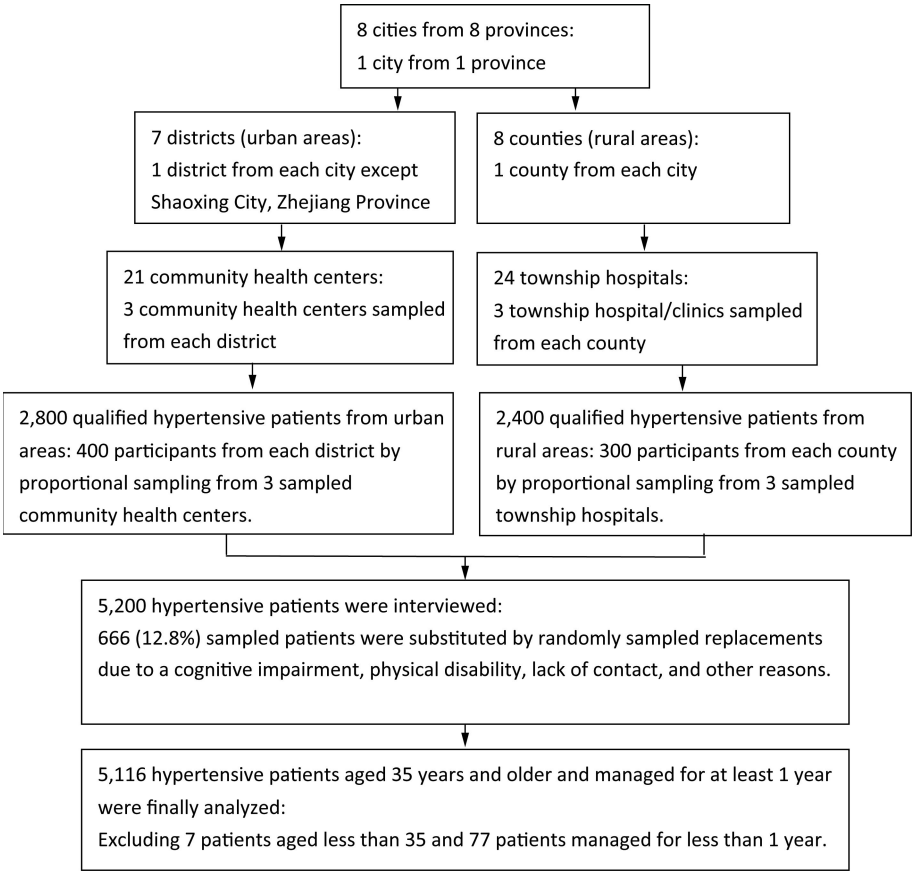

Figure 1. Flowchart for the selection of the samples.

Each participant was asked 22 questions on hypertension-related topics, such as the recommended daily salt intake, definition of high blood pressure, and risk and treatment of hypertension. The total awareness score of knowledge about hypertension was calculated using one point per correct answer, with the range of 0-22. Dietary Diversity Score (DDS) was used as an indicator of the overall diet to evaluate the diet quality of the subjects[6]. We used a simplified DDS by referring to the FAO standard[6], calculating the score of eight food groups (grains, meats, fish, fresh vegetables, fresh fruits, eggs, milk products, and bean products) with one point per category and DDS ranging from 1 to 8. Knowledge score and DDS were both analyzed as binary variables with the median score of 11 and 7 as the cut-off point, respectively. The exercise status was evaluated by asking the question, 'Did you ever exercise actively for the fitness of your body during the last 12 months?'

Medical treatment for hypertension was defined as a self-reported use of antihypertensive drugs during the management period. To test the effective control of hypertension, we measured the blood pressure of the participants using a standardized mercury sphygmomanometer. With the participant in a seated position after 5 min of rest, three consecutive readings of blood pressure were taken on the left arm; the mean of the second and third measures was used for the analysis. Hypertensive participants were regarded as having a controlled blood pressure if the systolic and diastolic blood pressures were < 140 mmHg and < 90 mmHg, respectively.

The research was approved by the Ethics Committee of China CDC (No: 201210). The interviewers provided an explanation of the written informed consent to the subjects before the survey. Only eligible patients who had signed the consent were included in the study.

SAS Software (Version 9.4) was used to perform statistical analysis. χ^2 tests were performed to explore the single-factor comparison between the groups with and without standardized management. Generalized estimating equations with a binary distribution were fitted respectively to explore the effects of the standardized management on the knowledge, lifestyle behavior, treatment, and control of hypertensive patients after adjusting for socioeconomic and demographic factors and the aggregation of the participants within the same PHI. Significance was set at $P < 0.05$.

Of the 5,116 participants analyzed, over one half were female (56.5%) and aged above 65 years (59.4%). Most of the participants had an elementary school education or less (62.8%). Nearly one half (49.2%) reported that their average annual household income was less than 10,000 RMB. Almost all the participants had at least one type of medical insurance (99.2%). The percentage of hypertensive participants receiving standardized management was 56.2%. Additional descriptive characteristic information is presented in Table 1.

Table 1. Demographic, Socioeconomic, and Clinical Characteristics of the Participants

Characteristics	Participants (*N* = 5,116)	Percentage (%)
Area		
Urban	2,754	53.8
Rural	2,362	46.2
Gender		
Male	2,227	43.5
Female	2,889	56.5
Age (y)		
35-64	2,077	40.6
≥ 65	3,039	59.4
Marital status		
Married	4,253	83.1
Unmarried, Divorced, or Widowed	862	16.8
Highest education level		
Elementary and below	3,211	62.8
Middle school	1,136	22.2
High school and above	769	15.0
Average annual household income (RMB)		
< 10,000	2,517	49.2
≥ 10,000	2,201	43.0
Refuse to answer	398	7.8
Having medical insurance		
Yes	5,075	99.2
No	41	0.8
Duration of hypertension (y)		
1-4	1,669	32.6
5-9	1,157	22.6
≥ 10	1,397	27.3
Unknown	893	17.5
Standardized management		
Yes	2,874	56.2
No	2,242	43.8

Among the hypertensive participants with the standardized and non-standardized managements, 62.2% and 47.5%, respectively, obtained a higher knowledge score. Of the participants with the standardized management, 61.7% acquired a better DDS, 56.2% exercised in the past year, and 82.6% were treated with antihypertensive drugs. The blood pressure control rate of the standardized and non-standardized management groups was 55.2% and 45.4%, respectively. The knowledge, lifestyle behavior, treatment, and control rates of the standardized management group were all significantly higher than those of the control group (χ^2 test, $P < 0.0001$) (Table 2).

After adjusting for sociodemographic factors, including area, age, gender, education, marital status, household income, and the duration of hypertension diagnosis, it was found that the hypertensive patients with standardized management had 1.698 times the odds of obtaining a higher knowledge score compared with those receiving non-standardized management [odds ratio (*OR*) = 1.70, 95% *CI*: 1.30, 2.22, *P* = 0.0001]. Furthermore, the participants receiving standardized management were more likely to acquire a better DDS than those receiving non-standardized management (*OR* = 1.22, 95% *CI*: 1.02, 1.46, *P* = 0.0302). The exercise status was not significantly different between the different management groups after adjusting for other factors. Regarding medical treatment status, patients with standardized management were more likely to take antihypertensive drugs than those with non-standardized management (*OR* = 1.37, 95% *CI*: 1.14, 1.64, *P* = 0.0007). Moreover, patients with standardized management were more likely to exhibit controlled blood pressure than those with non-standardized management (*OR* = 1.30, 95% *CI*: 1.11, 1.52, *P* = 0.0009). The relationship between other predictors and the knowledge, lifestyle behavior, treatment, and control status of the hypertensive patients is illustrated in Table 3.

Among the hypertensive participants who were managed by primary healthcare workers for at least 1 year, 56.2% received the standardized management, i.e., they received at least four follow-ups per year as well as specific advice on both medical treatment and healthy lifestyle behavior during each follow-up. The standardized management rate, which was roughly similar to those found in other surveys, reflected the accessibility of the health care reform measures regarding hypertension management[7-8]. Although the government issued standardized management regulations and provided substantial financial support for the hypertension management service, the implementation encountered some barriers[9]. Regarding service providers, our interview with the primary health care workers who were responsible for hypertension management showed that 63.0% of them reported being overburdened[10]. The incentives for primary health care workers were insufficient to motivate them to completely fulfill the task[11]. In this study, the hypertension control rate of 55.2% for the standardized management group is

Table 2. Knowledge, Lifestyle Behavior, Treatment, and Control Status of the Hypertensive Patients by Groups

Effect Variables		Standardized Management		Non-standardized Management		χ^2	*P*
		N	%	*N*	%		
Knowledge score	0-11	1,087	37.8	1,177	52.5	109.96	< 0.0001
	12-22	1,787	62.2	1,065	47.5		
DDS	1-6	1,099	38.3	1,011	45.1	24.25	< 0.0001
	7-8	1,772	61.7	1,230	54.9		
Exercise	Yes	1,615	56.2	1,119	49.9	20.08	< 0.0001
	No	1,257	43.8	1,122	50.1		
Medically treated	Yes	2,362	82.6	1,734	77.8	18.08	< 0.0001
	No	498	17.4	494	22.2		
Blood pressure under control	Yes	1,236	55.2	1,306	45.4	47.97	< 0.0001
	No	1,003	44.8	1,568	54.6		

Note. DDS, dietary diversity score.

higher than that for the non-standardized management group, which is also much higher than the average control rate of 17.2% for the Chinese hypertensive population treated with antihypertensive drugs[12]. However, the effective control level leaves much to be desired when considering the gaps with other studies; for instance, the control rate was 64.4% for the American hypertensive population under antihypertensive treatment in 2009-2010[13].

Notwithstanding the insufficiency of the management of hypertension, we still found that once the standardized management was completed, it had a significant and positive impact on the knowledge, lifestyle behavior, treatment, and blood pressure control. This is possibly relevant to the improved hypertension management policy environment, such as extensive health promotion, basic

Table 3. A Multivariable Analysis Fitted by the GEE Model Examining the Effect of Standardized Management on the Knowledge, Lifestyle Behavior, Treatment, and Control Status of Hypertensive Patients

Predictors	*OR* (95% *CI*)				
	Knowledge Score	Dietary Diversity Score	Exercise	Medically Treated	Blood Pressure under Control
Standardized management					
No	1.00	1.00	1.00	1.00	1.00
Yes	1.70 (1.30, 2.22)**	1.22 (1.02, 1.46)*	1.15 (0.92, 1.43)	1.37 (1.14, 1.64)**	1.30 (1.11, 1.52)**
Area					
Rural	1.00	1.00	1.00	1.00	1.00
Urban	2.36 (1.83, 3.03)***	1.53 (1.26, 1.86)***	2.70 (2.14, 3.39)***	1.32 (0.98, 1.77)	1.68 (1.40, 2.00)***
Age group (y)					
35-64	1.00	1.00	1.00	1.00	1.00
≥ 65	0.71 (0.60, 0.82)***	0.91 (0.80, 1.04)	1.31 (1.12, 1.53)**	1.00 (0.84, 1.19)	1.05 (0.92, 1.21)
Gender					
Male	1.00	1.00	1.00	1.00	1.00
Female	0.89 (0.77, 1.04)	0.81 (0.72, 0.90)**	0.84 (0.72, 0.99)*	1.29 (1.10, 1.50)**	1.11 (0.98, 1.26)
Education					
Elementary and below	1.00	1.00	1.00	1.00	1.00
Middle school	2.28 (1.88, 2.76)***	1.22 (1.04, 1.44)*	1.36 (1.13, 1.63)**	1.18 (0.94, 1.47)	1.07 (0.93, 1.23)
High school and above	4.17 (3.27, 5.32)***	1.34 (1.03, 1.73)*	2.00 (1.52, 2.62)***	1.07 (0.82, 1.41)	1.06 (0.89, 1.27)
Marital status					
Unmarried, Divorced, or Widowed	1.00	1.00	1.00	1.00	1.00
Married	1.37 (1.11, 1.70)**	1.25 (1.03, 1.52)*	0.90 (0.74, 1.10)	1.19 (1.00, 1.42)	1.06 (0.92, 1.22)
Average household yearly income					
< 10,000 RMB	1.00	1.00	1.00	1.00	1.00
≥ 10,000 RMB	1.43 (1.11, 1.83)**	1.28 (1.06, 1.56)*	1.30 (1.03, 1.64)*	0.86 (0.68, 1.08)	1.18 (1.00, 1.41)
Refused to answer	1.18 (0.68, 2.05)	1.12 (0.72, 1.75)	0.87 (0.48, 1.59)	1.08 (0.35, 3.14)	0.90 (0.67, 1.20)
Duration of hypertension diagnosis (y)					
1-4	1.00	1.00	1.00	1.00	1.00
5-9	1.41 (1.11, 1.79)**	1.11 (0.91, 1.36)	1.10 (0.92, 1.31)	2.27 (1.73, 2.97)***	0.94 (0.81, 1.11)
≥ 10	1.47 (1.12, 1.94)**	1.05 (0.83, 1.32)	1.08 (0.88, 1.34)	3.44 (2.27, 5.21)***	0.83 (0.70, 1.00)*
Unknown	1.11 (0.82, 1.51)	1.13 (0.86, 1.49)	0.76 (0.59, 0.99)*	0.78 (0.57, 1.08)	0.89 (0.71, 1.13)

Note. *, $P < 0.05$; **, $P < 0.01$; ***, $P < 0.0001$.

medical insurance, and essential medicine system following the implementation of China's new health care reform. Furthermore, community-based interventions for hypertension care in China were found to be effective in reducing blood pressure[14]. This effectiveness is closely linked to the efforts of primary health care providers. Grassroots health workers generally worked as a group to provide services, with the general practitioners providing clinical treatments and nurses and village doctors providing follow-ups and additional services from clinical treatments to lifestyle counseling[15]. By providing the routine face-to-face visits to the patients, the health care workers fostered a physician-patient communication. With regular follow-ups to ensure the intensity of the intervention, the hypertensive patients gradually improved their self-care skills for diseases. If the blood pressure was substantially uncontrolled, the primary health care workers had to transfer the patients to higher levels of care, such as hospitals. The standardized management in PHIs requires excellent communication with the basic professional medical services, which makes it particularly adaptable for regions with limited resources[16].

This is a cross-sectional study on 45 PHIs; thus, it cannot show a causal relationship. We will continue following up with the same group of hypertensive participants every 3 years in order to determine the long-term effects of community-based chronic disease management on population health in China. The interview was conducted mainly from the perspective of managed hypertensive patients. Most of the data except for the measurement of the blood pressure were based on self-reports; thus, a respondent bias was inevitable. For some indicators, such as the household income and duration of hypertension diagnosis, we classified the answers of 'unknown' or 'unclear' into a separate category to limit a bias in the analysis. In addition, the generalization of the study may be limited because the studied provinces and the districts were not randomly sampled.

In conclusion, adherence to standardized hypertension management provided by primary health care workers is associated with positive effects on hypertensive patients, including an increased hypertension-related knowledge, improved diet, enhanced antihypertensive treatment, and better blood pressure control, although the standardized management remains to be improved in both the distribution and quality itself. It is necessary to further educate and motivate primary health care workers by providing them sufficient training and reasonable incentives to ensure the full implementation and effectiveness of hypertension management.

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